Great Britain. Meteorological office. Geophysical memoirs. London. 1914.
Dines, W[illiam] H[enry]. The calibration of the balloon meteorographs and the reading of the traces. p. 147–152. (No. 6.)
Dobson, Gordon. A comparison of the electrical conditions of the atmosphere at Kew and Eskdale, with notes on observations of atmospheric electricity made in other countries. p. 155–169. (No. 7.)
Nautical magazine. Glasgow. v. 91. May, 1914.
Horner, D. W. Some weather problems explained. p. 432–437.
Physical review. Lancaster, Pa. v. 3. May, 1914.
Taylor, A. H. Radiotransmission and weather. p. 346–352.
Terrestrial magnetism and atmospheric electricity. Baltimore. v. 19. March, 1914.
Swann, W. F. G. The measurement of atmospheric conductivity, together with certain remarks on the theory of atmospheric radio-active measurements. p. 23–37.
Académie des sciences. Comptes rendus. Paris. tome 158. 9 mars 1914.
Szilard, B. Sur un paratonnerre au radium. p. 695–697.
Rothé, E., & Clarté, R. Influence de l'état de l'atmosphère sur la propagation et la réception des ondes hertziennes. p. 699–702.
Astronomie. Paris. 28 année. Mai 1914.
Loisel, J[ulien]. Durand-Gréville. p. 238–240.
Belgium. Observatoire royal. Annuaire météorologique. Bruxelles. 1913.
Chronique de l'observatoire royal. p. 9–20.
Heures de soleil à Uccle (Bruxelles). [1898–1912.] p. 21–25.
Temperature à Uccle (Bruxelles). [1906–1912.] p. 26–45.
La température de l'atmosphère jusqu'à 17 kilomètres, à Bruxelles (Uccle) et à Batavia. p. 53–55.
Ciel et terre. Bruxelles. 35 année. Mars 1914.
Bertyn, Félix. Un grain sans précédent pour le mois d'octobre. p. 90–93.
Nature. Paris. 42 année. 1914.
Berget, Alphonse. Baromètre marin à ébullition. p. 303–304. (28 mars.)
Vigneron, H. Les couleurs de l'atmosphère. p. 404–406. (16 mai.) [Based on A. Heim's "Luftfarben."]
Radium. Paris. tome 11. Mars 1914.
Pfund, A. H. Mesures thermo-électriques de la radiation solaire. p. 90–93.
Société Ramond. Bulletin. Toulouse. 3 sér. t. 7. Octobre-décembre 1912.
Marchand, E. L'observatoire du Pic-du-Midi en 1912. p. 141–148.
Annalen der Hydrographie und maritimen Meteorologie. Berlin. 42 Jahrg. 1914.
Herrmann, E. System der Einwirkung von Sonne und Mond auf die atmosphärischen Vorgänge und seine Auswertung. p. 121–141. (Heft 3.)
Pettersson, O. Studien in der Geophysik und der kosmischen Physik. p. 141–146; 209–219; 255–270. (Hefte 3, 4, 5.)
Exner, F[elix] M. Über die adiabatische Temperaturänderung trockener Luft. p. 150–152. (Heft 3.)
Köppen, W[ladimir]. Die Beziehungen zwischen Druck, Temperatur, Luftströmung und Depressionsbahn. p. 247–255.
Beiträge zur Physik der freien Atmosphäre. Leipzig. 6. Band. Heft 4. 1914.
Hergesell, H[ugo]. Die Messung der Vertikalbewegungen der Atmosphäre durch Pilotballone. p. 187–214.
Hergesell, H[ugo]. Die Ermittlung der Vertikalbewegungen der Atmosphäre und deren Turbulenz durch einen gefesselten Pilotballon. p. 214–224.
Hergesell, H[ugo]. Aerologische Studien im arktischen Sommer. p. 224–261.
Hamburg. Deutsche Seewarte. Aus dem Archiv. Hamburg. 36. Jahrgang. Nr. 3. 1913.
Mielke, Johannes. Die Temperaturschwankungen 1870–1910 in ihrem Verhältnis zu der 11-jährigen Sonnenfleckenperiode. p. 1–63.
Leipzig. Geophysikalisches Institut der Universität. Veröffentlichungen. Leipzig. 2. ser. H. 4. 1914.
Hesselberg, Th., & Sverdrup, H. U. Über den Einfluss der Gebirge auf die Luftbewegung längs der Erdoberfläche und auf die Druckverteilung. p. 101–116.
Meteorologische Zeitschrift. Braunschweig. Band 31. April 1914.
Woeikof, A[leksandr Ivanovič]. Klima des südlichen Sibirien. p. 161–169. [Abstract of work by Wosnessensky and Schostakowicz.]
Schmidt, Wilhelm. Über Luftwogen 1., Variogramme von Innsbruck. p. 170–186.
Letzmann, Johannes. Ein merkwürdiger Böentypus mit horizontaler Achse, beobachtet in Livland am 21. September 1913. p. 186–188.
Richarz, F[ranz]. Brockengespenst, Ballonschatten und ihr Lichtmaximum. p. 188–189.

Meteorologische Zeitschrift. Braunschweig. Band 31. April 1914—Con.
Bongards, Hermann. Über eine Beziehung zwischen Nebelhäufigkeit und Gehalt der Atmosphäre an radioaktiven Zerfallsprodukten. p. 189–190.
H[ann], J[ulius] v. Zum Klima von Albanien, Durazzo, Valona. p. 190–192.
A. Wigand: Das ultraviolette Ende des Sonnenspektrums in verschiedenen Höhen bis 9000 m. p. 192–193.
Maurer, J. Der Sonnenscheinchronograph. p. 193–196.
Woeikof, A[leksandr Ivanovič]. Temperatur Ende Januar und im Februar 1914 in Russland. p. 196–197.
Woeikof, A[leksandr Ivanovič]. Der Sturm am 13 Mai am Asowschen Meere. p. 197.
Wegener, Alfred. Staubwirbel auf Island. p. 199–200.
Liznar, J[oseph]. Zur Klärung der Frage, ob die Berggipfel kälter sind als die freie Atmosphäre. p. 201.
Schmidt, Wilhelm. Vergleich der Hauptbarometer der meteorologischen Zentralanstalten in Wien, Budapest, Belgrad, Sofia, Athen und Rom. p. 202–203.
Naturwissenschaften. Berlin. 2. Jahrgang. Heft 16. 17. April 1914.
Schachenmeier, R. Über den heutigen Stand der Theorie des Regenbogens. p. 384–388.
Bencke, Albert. Der Einfluss des Windes bei der Bildung von Ackererde. p. 396–398.
Wetter. Berlin. 31. Jahrgang. April 1914.
Grossmann, [L.] Wetterkarte und Wettervorhersage. p. 73–84.
Beukemann, A. Meteorologische und ozeanologische Beobachtungen auf Helgoland. p. 91–94.
Zeitschrift der Gesellschaft für Erdkunde. Berlin. No. 3. 1914.
Steffen, Hans. Zur Klimaforschung in Chile. p. 209–212.
Hemel en Dampkring. Den Haag. 11 Jaargang. Maart 1914.
K[ater], J. Het aardlicht. p. 164–166.
Maaninvloeden in de meteorologie. p. 169–171.
Pontificia accademia Romana dei Nuovi Lincei. Atti. Roma. anno 66. 1913.
Negro, Carlo. Sulla formazione della rugiada. p. 133–138.
R. Accademia dei Lincei. Atti. Roma. v. 23. 5 aprile 1914.
Eredia, Filippo. La distribuzione stagionale e annuale della nebulosità in Italia. p. 500–506.

NOTES FROM THE WEATHER BUREAU LIBRARY.

By C. Fitzhugh Talman, Junior Professor, in charge of Library.

NEW WAYS OF STUDYING CLIMATE.

There has recently been founded at Davos, the well-known altitude resort in the Swiss Alps, a private observatory that has set a new pace in the study and measurement of climate. This institution differs widely in its aims and equipment from every other observatory in the world, and an account of it should be of interest not only to the meteorologist and the climatologist but also to everyone who is concerned with any of the manifold applications of climatology, as the botanist, the zoologist, and the agriculturist. Especially, since the climate of Davos is renowned for its beneficial effects on consumptives, should the work of the new observatory interest the medical man.

At Davos, as at all other important health resorts, ordinary meteorological observations have been regularly made and their results have frequently been discussed from the medical point of view. A station of the federal meteorological service has existed at Davos since 1867, and is one of the best equipped in Switzerland. The observations are taken by officials of the Kurverein, and the results are posted daily outside the Kurverein building. Thus an instructive comparison may be made here between the methods of the old and the new climatology, as exemplified, respectively, in the official meteorological station and the newly founded private observatory.

The existence of the latter was made known to the world at large in the year 1911, when its owner, Dr. C. Dorno, published a voluminous account of his observations made during the three years 1908–1910.[1] Obliged for family

[1] C. Dorno, "Studie über Licht und Luft des Hochgebirges," Braunschweig, 1911.

reasons to live at Davos, Dr. Dorno set himself the task of studying the previously neglected factors in its climate. Ordinary meteorological measurements formed but a minor part of the program. His observations related to two principal subjects, viz (1) radiation, and (2) atmospheric electricity.

Measurements of the total solar radiation are no novelty. Formerly they were made with the now discredited black-bulb thermometer, and at present they are made at a comparatively small number of observatories with several forms of pyrheliometer. It is well known, however, that the various components of solar radiation—i. e., radiation of various wave-lengths—exercise quite different climatic effects, and, moreover, undergo different degrees of absorption in the earth's atmosphere. The most refined and detailed measurements in different parts of the spectrum are those made with the bolometer, but there are several less costly and elaborate instruments—none of them in general use by meteorologists—for studying particular regions of the spectrum. Dorno finds it convenient to measure separately (1) thermal radiation, (2) luminous radiation, (3) blue-violet and ultra-violet radiation. For (1) he uses a Michelson actinometer, checked by an Ångström pyrheliometer; for (2) Weber's photometer; and for (3) the Weber-Koenig photographic apparatus for the blue-violet, or photographically effective rays, and the Elster-Geitel zinc-globe photometer for the ultra-violet. The latter instrument depends upon the discharge by ultra-violet light of a negatively electrified body—the "Hallwachs effect." Finally Dorno has himself devised an ingenious instrument for making a continuous photographic record of the length of the ultra-violet spectrum, i. e., the value of the shortest wave-length that penetrates the atmosphere from the sun. This varies from day to day and from hour to hour.

It will be impossible within the limits of the present note to record all the interesting results attained through Dorno's novel and versatile observations, but we may pause here for a moment to mention a few things that he has found out, as a result of the measurements above mentioned, about the true inwardness of the famous Davos sunshine. This important therapeutic element varies greatly in quality with the season. The winter sun has great heat for the season, but very little ultra-violet radiation. The spring sun has the greatest heat, with slightly enhanced ultra-violet. The summer sun has great heat and the strongest ultra-violet. The autumn sun has great heat and but slightly diminished ultra-violet. Thus there is a very marked difference between spring and autumn at Davos as to the intensity of the ultra-violet radiation, a fact of much therapeutic importance. In commenting on Dorno's results Dr. Gockel has recently suggested that we have here an explanation of the so-called "glacier-burn," experienced by the invalids at Davos only in summer—it is probably due to the intense ultra-violet radiation. Dorno also finds that the heat of the sunshine at Davos varies quite regularly with the sun's angular altitude; that its luminosity varies somewhat with season and other conditions; that its photographic intensity (blue-violet) is still more influenced by atmospheric conditions, and bears comparatively little relation to the sun's altitude; and, lastly, that the ultra-violet radiation undergoes a hundredfold more variation than the heat, and, as stated above, varies greatly with the season; so that a single day in summer may give as much as a whole month in winter. The applications of such facts must be left to the biologist, the physiologist, the therapeutist; they can hardly fail to be of great value.

We can only briefly mention some of the other lines of investigation carried on at this unique observatory. Dorno's book on the subject is a mine of information and especially of suggestion, from which each reader will pick out the facts that bear upon his own particular sphere of interest.

As to radiation, the direct rays of the sun are only part of the problem. The combined radiation of sun and sky is measured at Davos, especially as to luminous and photographic intensity. In this connection several interesting facts have been brought to light; e. g., the comparatively small luminous but great photographic intensity of the diffuse blue light of the sky. Studies are also made of the color-composition of the light (red and green). Finally, the effects of different degrees of cloudiness are measured. All these observations are carried out with apparatus devised by Prof. Weber of Kiel. Nocturnal radiation from the earth is measured with A. K. Ångström's "tulip" apparatus.

The observations in atmospheric electricity include measurements of potential gradient, conductivity, the earth-air current (deduced from the two preceding), dissipation, and induced radioactivity, according to methods developed in very recent times, but presenting no novel features to persons familiar with contemporary (mainly German) literature on this subject. Benndorf electrometers are used, wherever appropriate, to secure continuous registration. Dorno draws from his observations various conclusions as to the relations of electric phenomena to the therapeutic features of the Davos climate—e. g., the relation between electric conductivity and the purity of the air; the stimulating effect of the earth-air current; and the probable physiological influence of the greatly increased conductivity observed during a foehn wind—for the details of which the reader must consult his work above cited.[2]

Several subsidiary lines of work that we have not space to mention are carried on at the observatory. A list of its instrumental equipment reads like the catalogue of a meteorological museum, including some forms of apparatus that are not familiar even by name to most meteorologists—such as Frankenhäuser's homœotherm, for measuring the cooling effect of the atmosphere; Wolpert's carbacidometer, for determining the amount of carbon dioxide; and the Engler-Sieveking fontactoscope, for measuring the radioactivity of springs.

From the *Zeitschrift für Balneologie* for April 15, 1914, page 54, we learn that institutions more or less analogous to Dorno's observatory are to be established under official auspices at Kolberg, a seashore resort on the Baltic, and at Oberhof in the Thuringian Forest, which is intermediate in altitude between Davos and Kolberg. This is part of a program which contemplates elaborate physical, meteorological, physiological, and psychological investigations of climate at a large number of German health resorts, to be carried out under the direction of Drs. Hellmann, Zuntz, and His.

In all this we have a signal recognition of the inadequacy of the existing data of meteorology for many, if not most, of the purposes of medical climatology.

"STRAYS" IN RADIOTELEGRAPHY.

A condition of the ether characterized by the occurrence of erratic signals in wireless telegraphic receivers due to natural electric waves is perhaps best known to American operators under the name of "static." These

[2] The medical reader should also consult Dorno's "Vorschläge zum systematischen Studium des Licht- und Luftklimas," in Zeitschrift für Balneologie, May 15 and June 1, 1912.

waves, or their effects, have been variously known as "strays," "statics," "atmospherics," and "X's." In France they are often called "parasites."

This subject is of meteorological interest for the reason, among others, that "strays" are produced by lightning discharges, and furnish a means of observing the occurrence and movements of distant thunderstorms. Thus we have several forms of thunderstorm-recorders, some of which ("ceraunographs") inscribe an automatic record, while others ("ceraunophones") are fitted with telephone receivers for producing audible signals. Most of the existing literature on thunderstorm-recorders conveys the impression that all of these natural signals are due to lightning, either near or distant, but the trend of opinion among special students of this subject is now toward the belief that "strays" are of various origin, in part extraterrestrial.

Perhaps the most active student of these phenomena is Dr. W. Eccles who, in collaboration with H. M. Airey, published an important paper on the subject, "Note on the Electrical Waves Occurring in Nature," in the proceedings of the Royal Society, series A, volume 85, 1911, pages 148–150. Recently the British association has appointed a committee, of which Dr. Eccles is secretary, to investigate these and other obscure phenomena connected with radiotelegraphy.

In the Yearbook of Wireless Telegraphy and Telephony (London) for 1914, Dr. Eccles publishes an account of the investigations undertaken by this committee and specimens of the observation forms which have been distributed to wireless operators throughout the world who are cooperating in the work of the committee. In the United States observations are being made by the Signal Corps of the Army and also at certain universities. The following quotation from Dr. Eccles's paper represents the existing state of knowledge in regard to "strays":

> These natural electric waves cause erratic and troublesome noises in the telephone receivers of a wireless telegraph station or cause erratic and confusing marks on the tape of a coherer and inker set. They are only too familiar to everybody who has worn the phones of a wireless operator for even a brief interval. For brevity they were christened "strays" or "X's" in the years 1897, 1898, and 1899 in England and were later given the name "atmospherics" in the United States. Another and more recent Americanism is "static." The best name appears to the writer to be "strays," for the word exactly describes their vagrant nature and does not commit one to any opinion as regards their origin. The much-used word "atmospheric" suggests that they are wholly due to discharges of atmospheric electricity, and no doubt the word "static" is intended to convey the same idea. "Atmospherics" is, besides, a dreadfully long word to have to write often. From the point of view of brevity "X's" is the best term, but it is not quite accurate. On the whole, from the point of view of priority, of accuracy, of freedom from ambiguity, and of the absence of bias—not to mention reasonable brevity—the writer favors the term "stray" as the best short term for a natural electric wave train, with "X" as a good variant. The latter term may be held to include, as "stray" does not, the noises caused by discharges of local atmospheric electricity down the antenna.
>
> Now, to the scientific mind, the chief claim of strays to promptness of attention is that nobody knows completely what they are or whence they come. The study of strays was begun by Popoff shortly before the rise of practical wireless telegraphy. In 1895 Popoff made use of a long vertical conductor (such as a lightning rod) in combination with a coherer in order to follow the motions of lightning storms across the country. A filings coherer was used, and was automatically tapped back after registering the effect of each lightning stroke. In 1898 Boggio Lera improved on Popoff's apparatus as regards sensitiveness and arranged that feeble and strong disturbances should be recorded separately. His experiments with this apparatus in 1899 showed that the approach of electrical storms was heralded by frequent operation of the apparatus several hours in advance of their arrival in the locality of the observing station and showed also that every visible flash operated the apparatus infallibly. These results were confirmed in 1900 by Tommasina, using his carbon autodecoherer. In 1901 Fenyi showed that the thunderstorms occurring within 100 kilometers of his station at Kalocsa, Hungary, were all recorded by his coherers. Finally, Turpain, in 1903, made a long series of observations which proved the possibility of utilizing radiotelegraphic apparatus in the forecasting of thunder weather for hours and even days in advance.
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> But even when there is no thunder weather recorded over the whole continent of Europe and the adjacent seas, X's may be received almost perpetually by a receiving antenna adjusted to a great wave length. This is quite a distinct matter from the X's due to local atmospheric electricity utilizing the antenna as a lightning rod and different again from the hum or sizzle or fizz caused by a white squall at sea or by glow discharge to high peaks. These perpetual strays are characterized by the fact that they are heavier and more frequent, in general, the longer the wave to which the receiving antenna is adjusted, so far as has been tried up to the present. It is natural but it is not scientific to jump to the conclusion that these strays are all due to lightning strokes occurring probably at great distances somewhere on the earth's surface, or possibly in the free atmosphere between one bank of ionized air and another. This, however, ignores the possibility that the source of the strays may be far outside the earth. There is nothing unreasonable in supposing that the sun, let us say, may send us occasional electric waves. For example, in the colossal movements of matter associated with the formation of a solar prominence—movements that appear to take place with enormous velocities—electric discharges may be brought about of magnitude far transcending anything that can happen on the earth. These would give rise to electric waves which might reach the earth in perceptible intensity and constitute a proportion of our strays. On the other hand, we must not forget that we on the earth's surface may be protected by our ionized atmosphere from these extraterrestrial waves. It is just such problems as these that the British Association Committee has set itself to inquire into.

The writer further explains that three kinds of strays are commonly heard during the telephonic reception of signals. One is a more or less prolonged rattling or grinding noise ("grinders"); another kind consists of sharp isolated knocks ("clicks"); and a third consists of a buzzing or frying noise ("hum" or "sizzle"), and is often heard during a white squall. A period of unusually loud or numerous strays is known as an "X" storm. In the scheme of coöperative observations, since the character and number of strays received differ greatly with the wave length to which the receiving apparatus is adjusted, observations are requested especially on two wave lengths, viz, about 600 meters and about 2,000 meters, while observers possessing the necessary apparatus are requested to add records made with about 5,000 meters wave length. Observations are especially desired at 11 a. m. and 11 p. m., Greenwich mean time, as simultaneous observations in various parts of the world will indicate whether particular cases of strays may be of world-wide or widespread occurrence, pointing to a cosmical origin. Observations are also desired about the transition time between daylight and darkness. The forms furnished to observers call for information regarding various concomitant meteorological phenomena, such as the kind of clouds, wind, barometer, temperature, etc.